Solenoid Ring Tracking in GEANT
Status Upate

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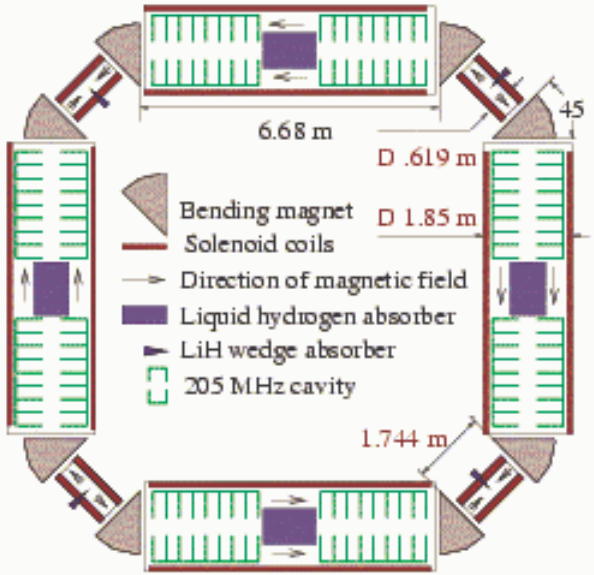
Topics to be Addressed

- Hardedge Field model:
  - We have seen at Shelter Island that R. Fernow's ICOOL model for the Balbekov ring does reproduce Valeri's Ring simulation.
  - The GEANT model at this point does not.
    - Significant losses (33%) occur in the first turn.
    - High residual losses occur after that.
    - Cooling that is observed is more likely related to these losses.
  - This presentation summarizes my current understanding of this.
    - It is hard to make progress on the realistic field scenario, since it is likely to be worse than the hardedge model.
- Realistic Field Model:
  - What I intend to try next.

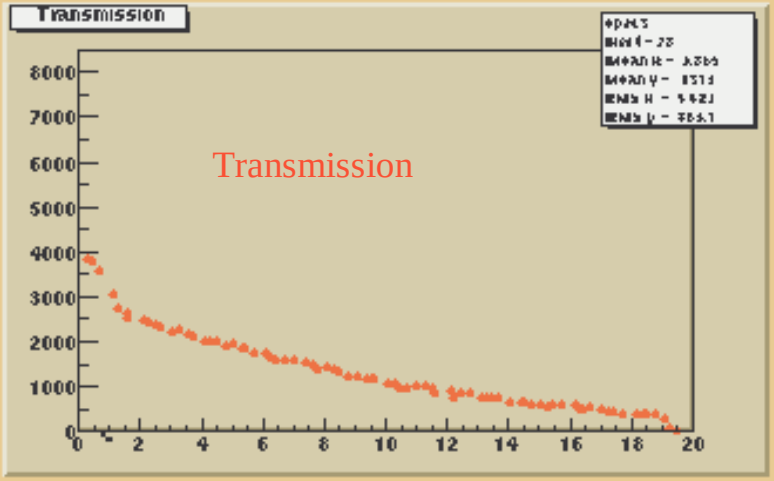
Ring Cooler Geometry

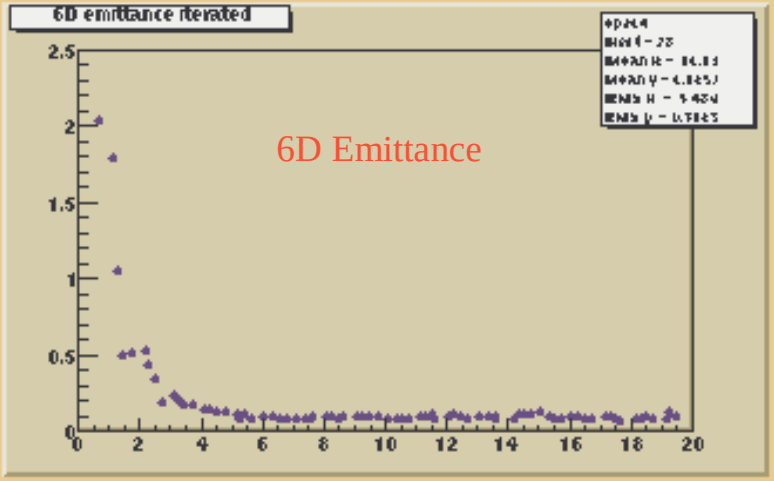


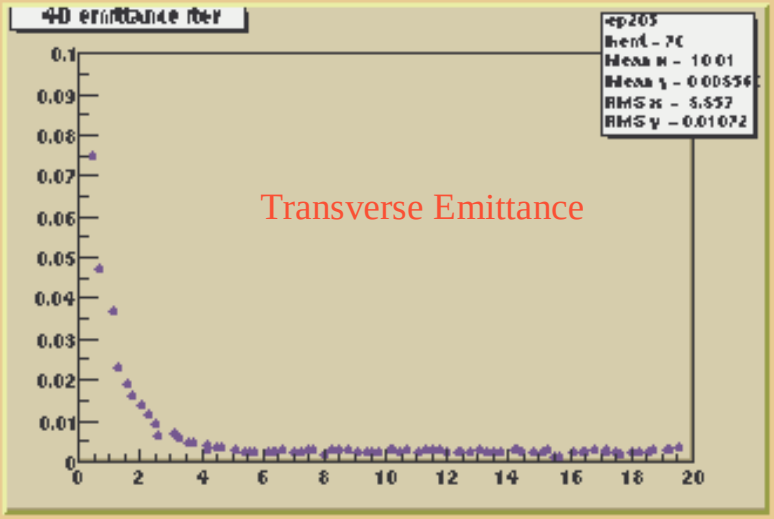
Circumference	36.963 m
Nominal energy at short SS and bends	250 MeV
Bending field	1.453 T
Norm. field gradient	0.5
Max. solenoid field	5.155 T
RF frequency	205.69 MHz
Accelerating gradient	15 MeV/m
LH_2 absorber length	128 cm
LiH wedge absorber	14 cm
Grad. of energy loss	0.75 MeV/cm

Simulation Conditions

- File of ~2500 muons in a bunch with following characteristics:
  - $\sigma_x = \sigma_y = 4$ cm.
  - $\sigma_{ct} = 8$ cm.
  - $\sigma_{Px} = \sigma_{Py} = 32$ MeV/c
  - $\sigma_E = 18$ MeV/c
  - Correlation between P_T and E taken into account.
- The beam is *inserted* in the center of the absorber in the long solenoid.
- The RF is phased at 34° and the gradient is adjusted to produce the right longitudinal momentum to match the dipole field.

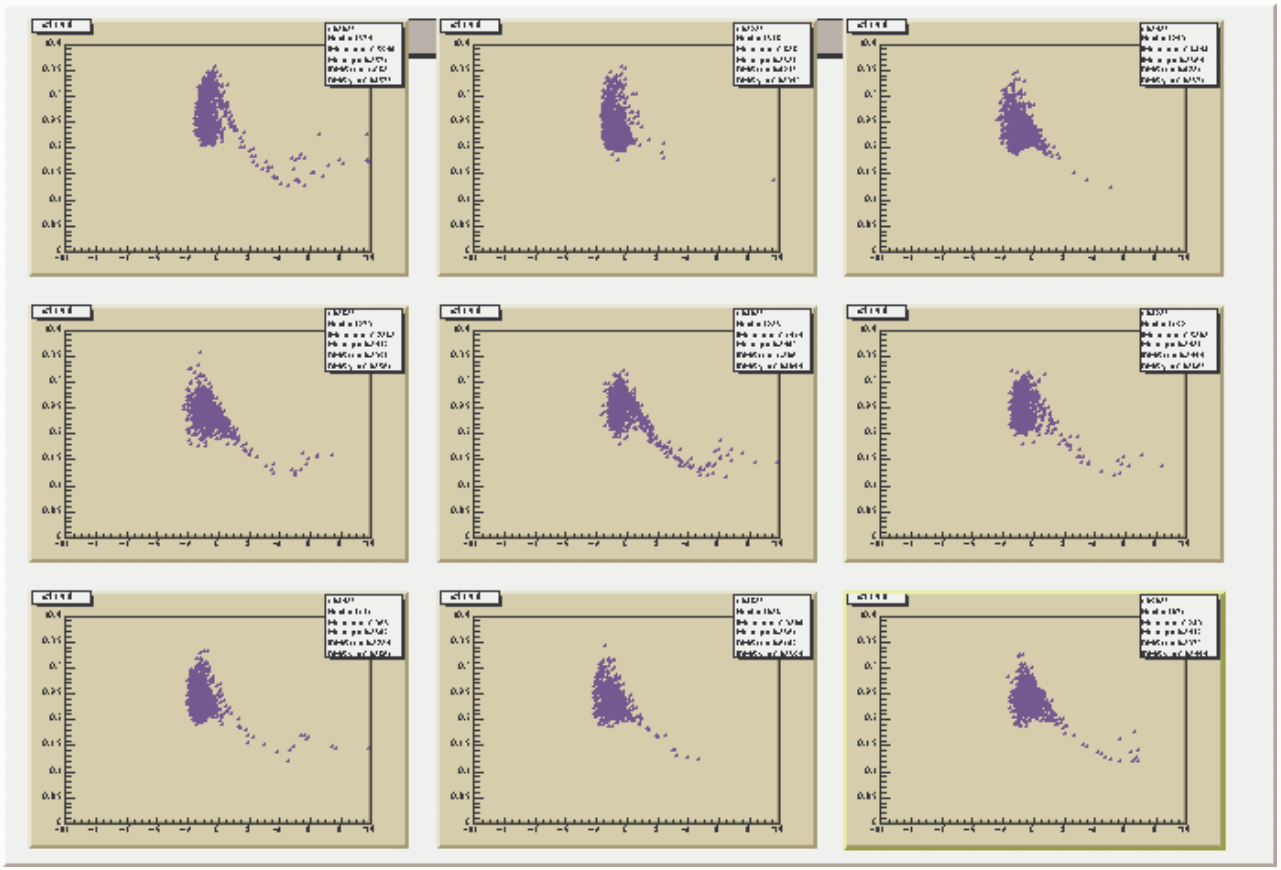

Transmission
Transmission


6D emittance iterated
6D Emittance


4D emittance iter
Transverse Emittance

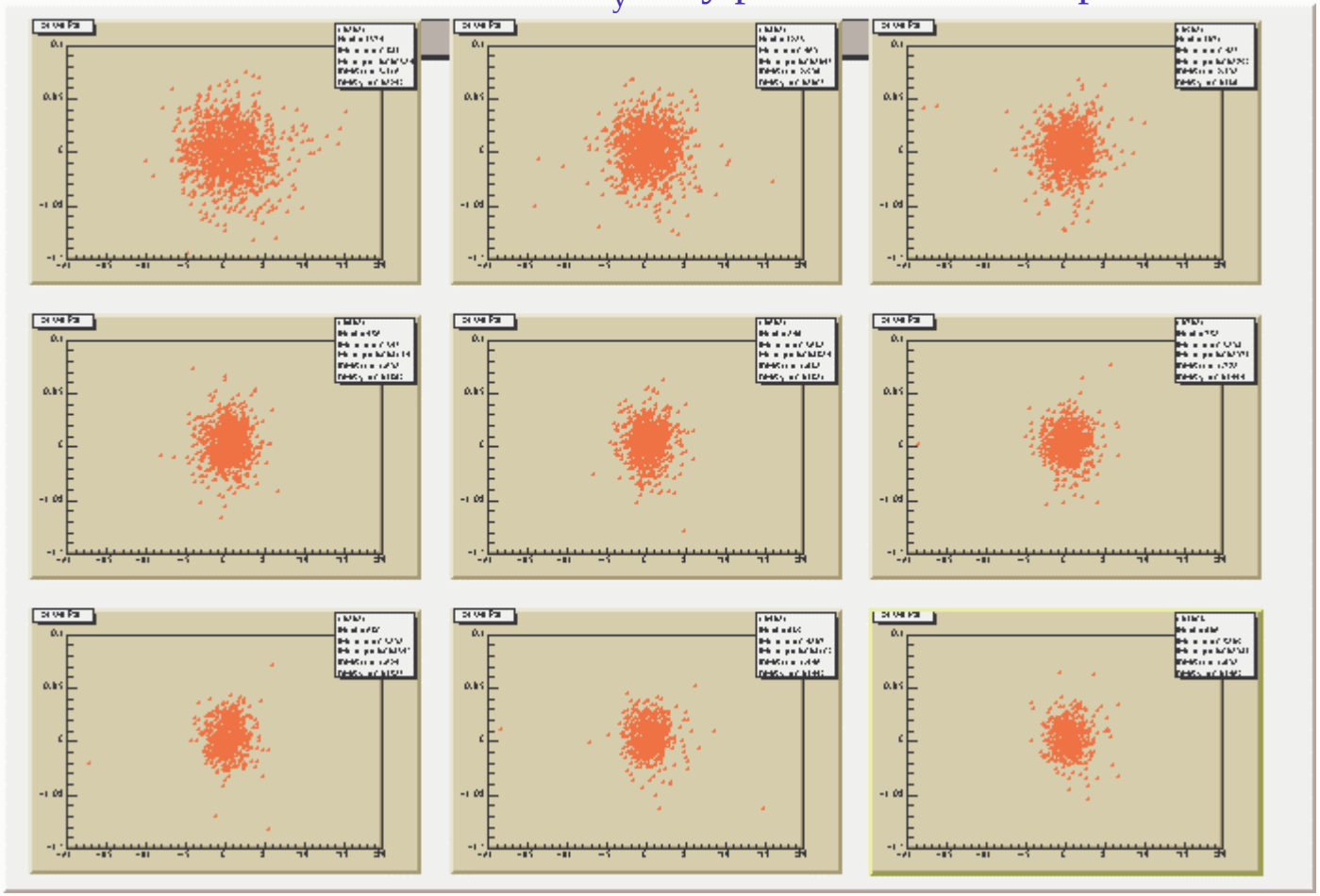
E vs. ct Plots for First 9 Turns

Particle Losses are evident in this plot



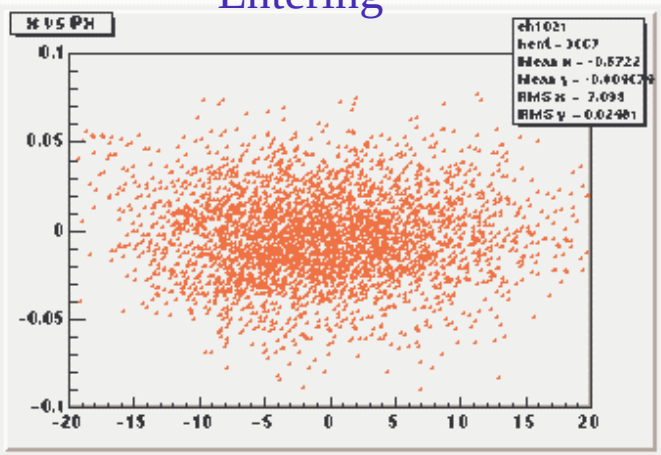
P_x vs x Plots for the First 9 Turns

P_y vs. y plot shows similar profiles.

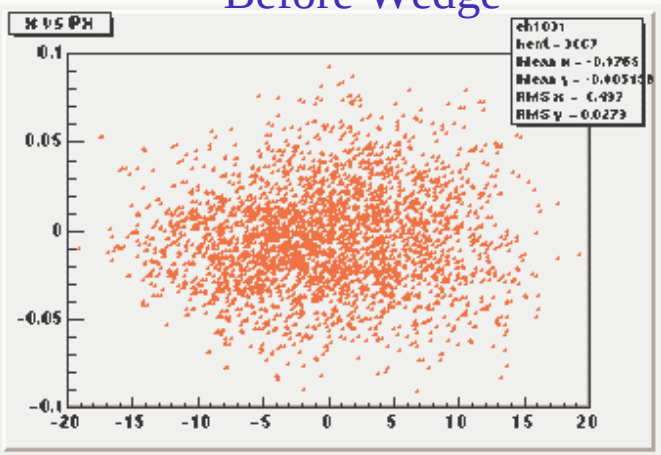


P_x vs. X in First Short Solenoid

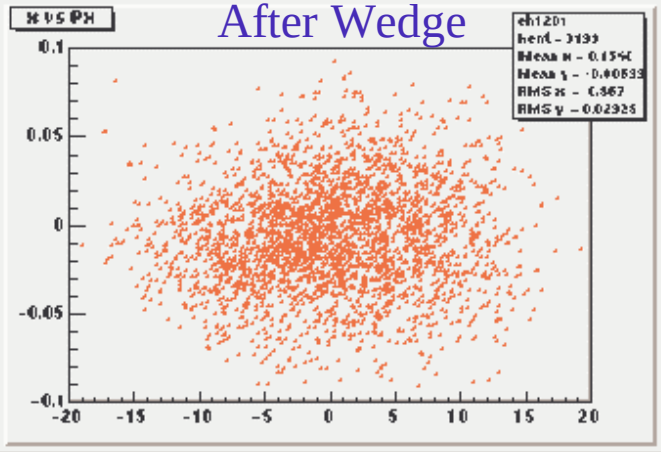
Entering



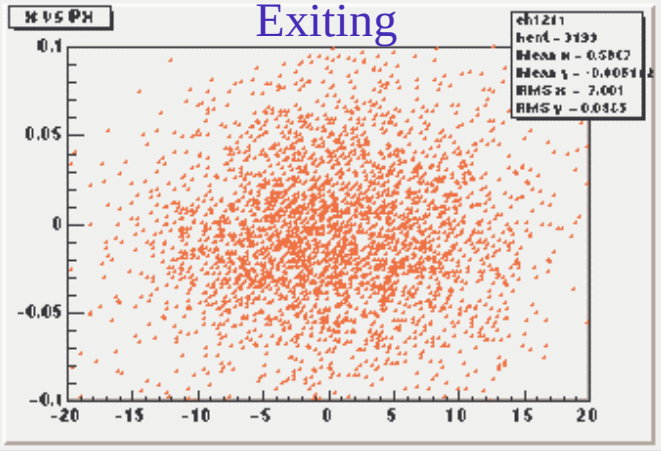
Before Wedge



After Wedge

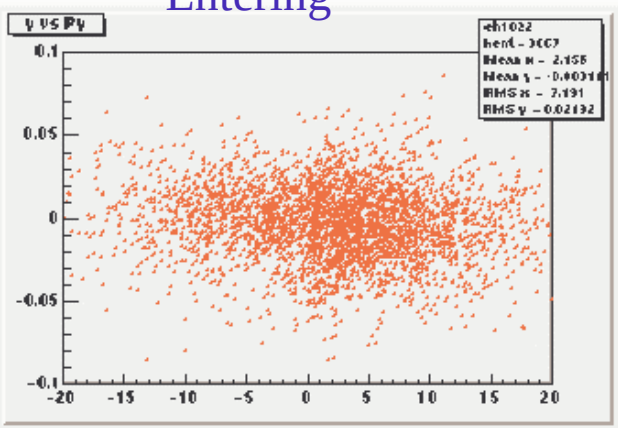


Exiting

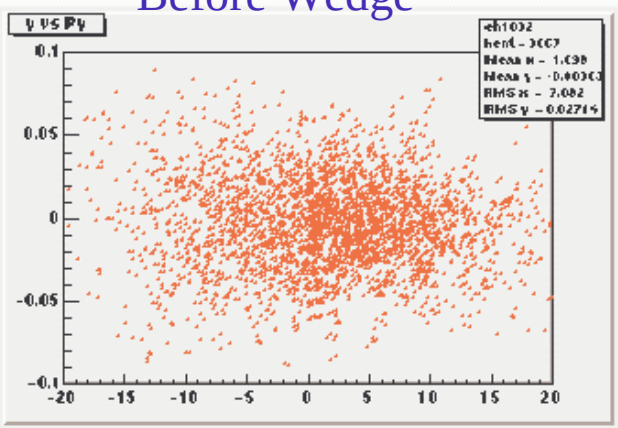


P_y vs. Y in First Short Solenoid

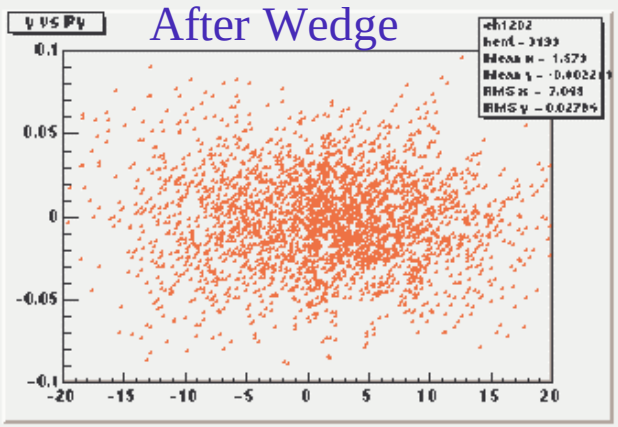
Entering



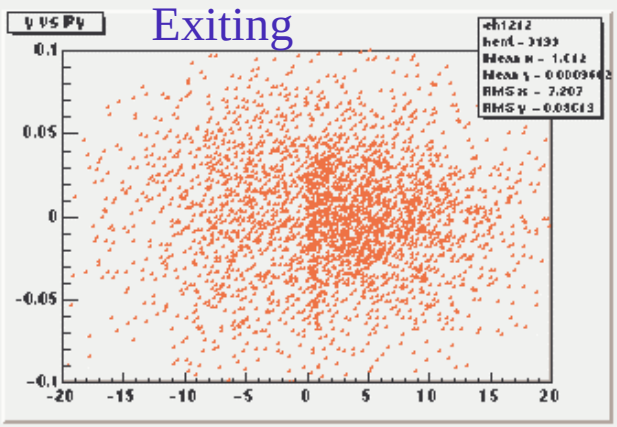
Before Wedge



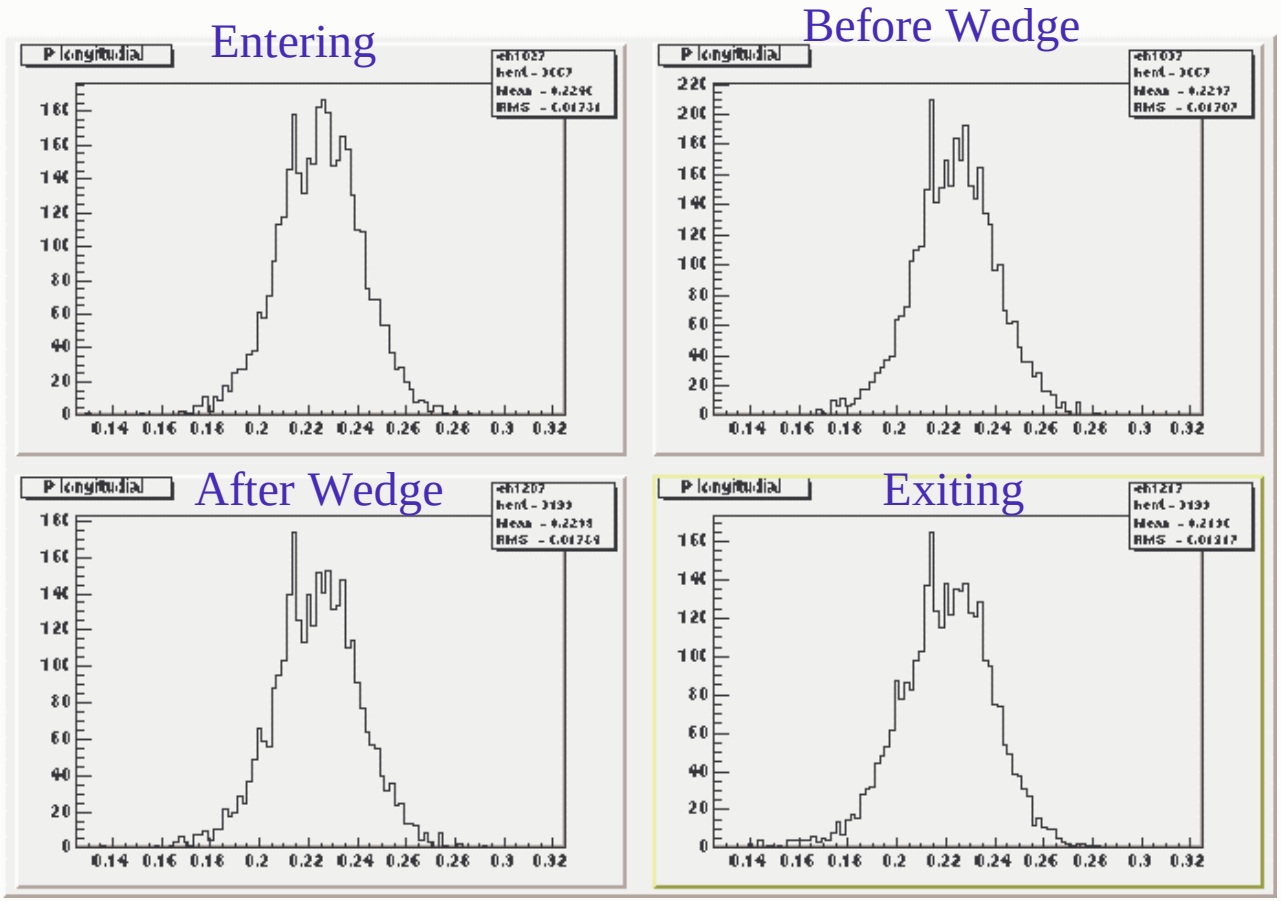
After Wedge



Exiting



P_L in First Short Solenoid



Position	P_L	σ_P
Entering	224.888	17.07
Before Wedge	223.906	16.94
After Wedge	223.705	17.507
Exiting	220.2	18.353

Position	σ_{Px} MeV/c	σ_x cm	<x> cm
Entering	23.825	7.0816	-0.7585
Before Wedge	26.692	6.5975	-0.472
After Wedge	28.117	6.4212	0.1396
Exiting	38.885	6.9606	0.6136

Position	σ_{Py} MeV/c	σ_y cm	<y> cm
Entering	21.169	7.2453	2.5377
Before Wedge	26.080	7.2331	1.8868
After Wedge	27.400	7.1606	1.7564
Exiting	36.297	7.3454	2.0016

Changes for Realistic Fields

- Concerns for Realistic fields can be put into two classes:
  - Those changes that need to be made to satisfy *Maxwell's equations.*
    - This is more easily achievable. It usually involves rounding step function fields by over a distance of approximately the size of the aperture.
  - The second classes of changes have to do with whether one can implement it.
    - As an example, one can ask if there is indeed enough space between the dipole and the solenoids to return flux.
      - In previous talks, I have indicated that a minimum distance between the dipole and solenoids would be ~40 cm for end plates and flux clamps.
      - Putting a 40 cm drift space in the ring cooler lattice would at best significantly change the performance.
- I intend to try to put coils on the inside of the solenoid end plates (as shown in the next transparency.)
  - I am not sure if one would want to build it this way, but…
  - One price that would be paid is that the solenoid would not be completely decoupled from the dipole. However most of the flux would still be returned in the end plates.

Long Solenoid Magnet